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U. S. DEPARTMENT OF LABOR

W. B. WILSON, Secretary

WOMEN'S BUREAU

MARY ANDERSON, Director

# A PHYSIOLOGICAL BASIS FOR THE SHORTER WORKING DAY FOR WOMEN

BY

DR. GEORGE W. WEBSTER



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*America will be  
as strong  
as her women*

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Ray E. Stoughton

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF LABOR,  
WOMEN'S BUREAU,  
Washington, February 1, 1921.

SIR: Transmitted herewith is a paper written by Dr. George W. Webster, member of the Illinois Industrial Survey, appointed by the governor in 1918, which was read by him before the Illinois Women's Legislative Congress at their meeting, December 28, 1920. It deals with the physiological basis for the shorter working day for women in industry and is important from the point of view of fatigue and studies made on production. The Women's Bureau has secured permission from Dr. Webster to publish this material.

Respectfully submitted.

MARY ANDERSON, *Director.*

HON. W. B. WILSON,  
*Secretary of Labor.*





## A PHYSIOLOGICAL BASIS FOR THE SHORTER WORKING DAY FOR WOMEN.

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"Women will be found to be fearfully weighted in the race for life. The duty of man is to see that not a grain is piled upon that load beyond what nature imposes; that injustice is not added to inequality."

HUXLEY.

Labor is the foremost domestic problem confronting the American people to-day. One of the most important phases of that problem for both men and women is the question of hours. The importance of this question to women is shown by the fact that there are about twelve millions of women employed in the hundred and more leading industries of the United States to-day.

Ever since the time when "Adam delved and Eve span," cheerfully and uncomplainingly woman has done a large share of the world's work. In 1630 it was thought that devils went into old women. At the same time live cats were broiled over a fire, not because of any ill will toward the cats but to get the best of the devil. Now the real reform consists in reforming the community thinking about the matter.

In any small town in the Southwest you may see bronchos standing in the streets, their bridle reins thrown over their heads and touching the ground in front of them. They will not attempt to run away. They have been trained to think they are tied. They are tied by an idea. Men are like these bronchos. Man does not reason as much as he thinks he does. Thinking has never been popular; it is too difficult. Looking backward over the 40 years of conflicts, hopes, opinions, and legislative enactments we see that men, confronted by the problem of need for increased production, have employed what the psychologists call the "trial and error" method of the unthinking animals, and have assumed that increased production is best accomplished by increasing the number of hours of labor. They have been tied, fettered by this idea, which has been proved so erroneous. Nothing in industry is now better known than that lengthening the hours of labor beyond a certain point not only does not increase but actually diminished output. Out of long periods of progress by conscious "trial and error" some truths eventually emerge, and here again the one fundamental achievement has been the reform in the community thinking about the matter. Having learned this, and admitting its truth, we inquire what is the great problem, the correct solution of which confronts us?

### WHAT IS THE PROBLEM?

Industry is at bottom essentially a problem in man power. One important element in this problem is the question of pooling all this human power for the good of the industry and of all those engaged in it, while still securing the maximum production.

Thus it appears that one of the most important phases of the labor problem to-day is the question of hours. What is the minimum number of hours in which the worker may produce the maximum output, day after day, week after week, year after year, and remain well, at least so far as injury from overwork is concerned? This problem affects all classes, as it involves and concerns national wealth and national vitality, and the perpetuity of the race. Of equal importance with the problem itself is the question of how it shall be solved. It is of paramount importance that the forward-looking among us go to work in a calm, orderly, large-minded, farsighted, constructive manner to determine and establish a standard of working hours; but it is of infinitely greater importance that this standard shall be right, and that it be established on a strictly scientific foundation, a foundation, a standard, determined by the united efforts of the physiologist, the psychologist, the engineer. This standard should be for all who labor in industry, men and women alike.

#### ARGUMENTS AND EVIDENCE IN SUPPORT OF THE EIGHT-HOUR DAY.

At the beginning of any intelligent discussion of any opinion in regard to whether a day should be 8 or 10 hours or longer, we should know the kind of evidence on which the opinion is based, and how that evidence was obtained. It is absolutely and fundamentally essential that any opinions in regard to fatigue and output or hours and output, or any other physiological evidence, should be based on a method of procedure outlined and planned by an expert on industrial physiology. The work done by such men as Frederick S. Lee (10)<sup>1</sup> or P. Sargent Florence (4) is an illustration of the best type of this kind of work.

The opinion of such organizations as the National Industrial Conference Board (11) should be accepted with caution, and only after carefully considering the fact that their evidence was obtained by means of the questionnaire and not by the physiological method, which many believe to be the only correct and reliable one.

To both the employer and the employee it may come as a distinct shock, and at least as a new idea, that science can be a service to industry in the proper solution of this question. First there is the natural hostility of labor toward science in general, because it has often meant only new and more complicated machines, something often impersonal and cruel. This is an erroneous view, for science is not a body of beliefs and opinions, but a way, a method of dealing with and solving problems. "Scientific method" is the term employed for the orderly and systematic effort to find out.

The employer regards as impractical the application of scientific methods to the solution of the problem of hours. To him it is a new idea, and "there is no pain like the pain of a new idea." The question must be finally settled by the fair cooperation of both employer and employee in collaboration with the physiologist, the psychologist, the engineer—after education—and not by any granting of favors by either side as though it were a charity. Both should cooperate, because the results are mutually advantageous. Having established

<sup>1</sup> Reference is made by number to "Literature cited," p. —.

a standard, it should then be enacted into law, but in fixing a standard for women the fact that they are women should be taken fully into consideration.

This standard should be a scientific standard; it should have a physiological basis. It is one of the most extraordinary facts in connection with the determination of the length of a working day that so little has been done to determine this physiological basis, and to apply in industry what is already known to science.

It has been abundantly demonstrated that the relations between labor and capital can not be left safely to the unfettered play of individual competition. What is far more important as a principle is that the regulation of hours and conditions of work is no longer a contest between labor and capital, especially so far as women are concerned; the State, society as an organic whole, is also concerned. We must see to it that both industry and labor have a correct conception of their relationship to society, but we must look fairly and impartially at both sides, as the problem is too important, too vast, to be looked at from only one side, for "no man understands his own side until he is familiar with the other side." Before attaining a satisfactory solution to the problem of labor and industry a great part of life will have to be reconstructed. It is of fundamental importance that this reconstruction shall be well revised from the start, free from the trial and error method, and based upon scientific rules, in order to avoid the unfortunate errors of the past.

### **Fatigue.**

Before attempting to answer the question—solve the problem of a standard of working hours—it will be necessary first to make a little study of the human machine and of fatigue; what it is, how it is produced, what it does, and how it may be regulated, and its harmful effects prevented.

In modern industry the science of machinery is developed to its highest point of perfection, in its construction nothing is left to chance, its type is related in accordance with its exact fitness for the work to be done, it is not overworked or overlooked, all questions relating to it have received careful study, and great care is exercised to secure and maintain the highest degree of output compatible with necessary wear and tear or injury to the machine itself. Unfortunately, the same thought, care, and attention have not been bestowed upon the human machine. In this connection, Prof. Frederick S. Lee, of Columbia University, who is one of the leading authorities on the subject, has said (10, pp. 2-3):

It is pertinent to our present purpose to regard this human element, the combined body and mind of the worker, as itself a machine. There is nothing derogatory to the worker in this conception; it is the customary conception of physiological science, which has learned to respect living substance above all other created things, and yet finds it most helpful to regard every living body as a mechanism working according to the fundamental laws of all mechanisms, but with its own specific ways of acting that characterize living in contrast to nonliving substance. No other factory mechanism approaches this human machine in its intricacy, the perfection of the correlation of its working parts, its combination of delicacy and strength, its adaptability to the work required of it. None is so essential to industry.

Nevertheless, the present ways of handling the human machine are empirical and crude. Experience has taught most industrial managers what they believe to be the proper way of dealing with the workers, and experience is con-

ceived to be the best guide. The thought that the worker is a physiological mechanism, and should be treated as such, that the problem of the worker is a physiological problem, is regarded as academic, fit for the laboratory, but not "practical" enough for the factory. That word "practical" is one of the most alluring, most dangerous, and most misused words in the English tongue. Crimes unnumbered have been committed in its name. It is true that the science of the human machine as employed in industrial work has not yet been developed so far as that of nonliving machinery. \* \* \*

The manager in industry gives his best thought to his machines, but to the living machines he has given little attention, and he has yet to be shown. The trouble is not with the experience, but with the experimenter. He gets what he is looking for, and does not question. Blind "trial and error" is the animal and the racial way, and, unfortunately, it continues to be the chief method of modern man, for psychology teaches us that man rarely stops to think out the correct method of procedure unless the difficulty is so great that no plan of action immediately presents itself.

The wonderful, amazing advance of the natural sciences during recent years is due to a new plan of campaign. The scientists now set no definite problems, plan their investigations so as to eliminate error, and put intelligence into nature's unintelligent method of progress. It is this intelligent planning, this looking ahead on the part of such men, that is enabling us to establish a scientific, physiological basis for the shorter day in industry, and the proper handling of the human machine.

In what essential respects does the human machine differ from the nonliving machine? The answer to the question is one of the keys that unlock the secrets of the whole question.

The human machine is subject to fatigue, the nonliving machine is not. Fatigue has been defined as a "diminution of working capacity, often accompanied by feelings of weariness, caused in the human organism by the length or intensity of some activity." (4, p. 15.)

Also: "The sum of the results of activity which show themselves in a diminished capacity for doing work." (6, p. 3).

This is well explained in Memorandum No. 7 of the British Health of Munitions Workers Committee. (6, p. 3):

In the animal body the performance of work depends on the activities of parts which are best considered under three groups—first, the complex nervous mechanisms of the brain and spinal cord which are concerned in the initiation and the distribution of impulses to action; second, the nerves which conduct the impulses to muscles; and third, the muscles themselves, which by contracting perform external work.

Fatigue has been separately studied in all these parts. In its essential features the fatigue of all alike has been found, when it occurs, to depend not upon the simple using up—exhaustion—of the substances supplying the chemical energy which is liberated during work, but upon the accumulation within the living elements of the products of the chemical changes involved. Fatigue of the animal machine, that is to say, is not to be compared with the failure of fuel in a steam engine, or with the running down of a clock weight, but rather with the clogging of the wheels in some mechanism by dirt.

Explained in another way, a tired person is one who is poisoned by the waste products formed in his own body. The human machine is of such marvelous and wonderful structure that, as Miss Josephine Goldmark (5, p. 13) puts it, "like a running stream, it purifies itself, and during repose these toxic impurities are normally burned up by the oxygen brought by the blood, excreted by the kid-

neys, destroyed in the liver, or eliminated from the body through the lungs." Income exactly balances expenditure, repair equals waste, so long as bodily and mental activity are balanced by rest and sleep. Rest is thus seen to be just as much active process as is work. So long as this equilibrium is maintained health is maintained, but as soon as it is destroyed there is an accumulation of waste materials; fatigue, exhaustion, impaired health, follow each other as consequence upon cause, the physiological is replaced by the pathological, and ultimately death may ensue. Between perfect metabolic balance, on the one hand, and death, on the other, there are a large number of sequences and a wide range and variety of injuries with which we must become acquainted and so be able to recognize and deal with intelligently by preventive means before irreparable injury or death occurs.

Fatigue, like pain, is one of the great safety valves of the human machine. It is protective. It is a physic defense. Like pain, it warns of and protects against that which is worse than itself. It is a sign that one is going too fast.

In the human engine certain food substances are eaten, digested, absorbed into the blood stream, assimilated or built up into living tissues, and part is transformed into heat and work in accordance with the laws of the conservation of energy. The building up and the breaking down are known as metabolism, this term including all those chemical processes the sum of which constitute life. During this complicated process oxygen is consumed, and this allows of the oxidation of foodstuffs at the temperature and under the conditions existing in the body.

In this process where work is done waste products of a chemical and essentially acid nature and known as fatigue stuffs are produced and accumulate in the blood and cause the phenomenon of fatigue. When one uses up more than the income of food and oxygen in a unit of time, it means overfatigue and the breaking down of tissue. It means spending not only all your income, but some of your reserve, your bank account, and if continued too far, may lead to physiological bankruptcy.

Industrial fatigue is defined as "diminution of working capacity caused by the length or intensity of some activity at a 'gainful occupation.'" (4, p. 20.)

It is the after effect of work. It is the condition of the worker's organism after he has expended energy in doing something. It is a necessary by-product of activity. Exertion not only temporarily uses up the energy of the body, but it also generates substances, poisonous in their nature, which slows one down. These substances may be removed by rest. The greater the fatigue the greater the time required to overcome it. Twice the amount of fatigue requires more than twice as much rest, and in exhaustion or excessive fatigue a condition obtains which may require that the rest period be prolonged indefinitely. When this overfatigue sets in efficiency becomes nil, and is thus an economic waste, and, because of its disastrous effects, a waste of life as well.

Fatigue is a physiological state which enters all human activities. Its normal manifestation constitutes a warning. If this warning is not heeded, the physiological may become pathological. It follows

as consequence upon cause that if work is done rest ultimately becomes imperative. Rest is nature's way of removing fatigue.

The elements of fatigue are, broadly speaking, both physiological and psychological. Ordinarily fatigue is thought of only as the necessary result of physical work. Nothing could be further from a correct conception than this.

Aside from physical labor, among the chief causes of fatigue in industry is speed. The telephone service may well be cited as an example of work requiring great speed. The average daily hours are eight and one-half, but what with overtime, Sunday work, "working through," loss of relief, or "excess loading," these are often exceeded. Two hundred and twenty-five calls per hour, or three and one-half per minute, seems an example of real "speed," and yet the "peak load" often exceeds this.

In the needle trades a girl tends a sewing machine carrying 12 needles making 4,000 stitches a minute, or 2,400,000 in 10 hours, often working in a bright light and with unshaded eyes, and amidst a noise that can only be described as a deafening roar.

Speed combined with monotony is also a potent factor in producing fatigue.

To hold one's self down to an uninteresting task by means of sustained voluntary attention results in rapid fatigue of brain tracts developed only late in human history and therefore especially subject to fatigue. This unnatural sustained effort is present in all the various kinds of industrial work where there is no immediate interest in the finished product, where it is necessary to hold one's self down to mere work for a certain number of hours each day. It is present in many kinds of clerical and office work, and in routine tasks of all kinds. The resulting fatigue is both physical and mental. Release from it is sought again in unnatural ways, sometimes in narcotics or stimulants, such as alcohol, tobacco, narcotic drugs, tea, coffee, sugar; sometimes in such amusements as dancing, moving pictures, and vaudeville shows requiring no exercise of volunatry attention; sometimes in various forms of social outbreak such as strikes, antisocial agitations, revolutions against existing morality and the existing social order; sometimes merely in reading journals or magazines of revolt. (12, pp. 136-137.)

In the pea-canning industry a girl inspects two cans of peas per second, or 72,000 per day. The cappers place the caps on the cans at the rate of 60 to 80 per minute.

In the shoe industry a workman revolves the shoe in such manner as to trim off the crimped surplus leather from the "upper." His task is 5,200 shoes a day.

In the eyeletting department of the shoe industry an expert worker can finish 2,000 pairs of women's shoes in one day. When it is remembered that each of these shoes has as many as 12 holes irregularly spaced, making 48,000 eyelets per day, a new idea of "speed" in industry is obtained.

These are merely a few examples of the monotonous and rapid work which is required of so many women in the industries of the country, and which by its very nature increases their burden of fatigue.

Noise is another element in fatigue, as are the rhythm and speed of the machine. The surrender of the worker to the time and rhythm of the machine becomes a source of fatigue because the machine is set for a constant uniform speed, while the worker becomes tired, and fatigue tends to slow him down, requiring a constantly increasing effort to maintain the same speed as the machine. He supplements the defects of the machine, becomes its eyes, legs, arms, anything it

needs, discards what is unnecessary for its requirements as valueless, stifles his creative impulses; and this leads to fatigue.

Other well-recognized conditions influencing the occurrence of fatigue are shop conditions, such as ventilation, temperature, humidity, lighting, rest periods, etc.

And just here the advocate of shorter working hours will be met by one of the most plausible but fallacious of arguments on the part of the employer. He argues that he has carefully tested it out on repeated occasions and finds that where he compares the output of a 10 and an 11 hour day the output of the latter is always correspondingly greater, and therefore he is sure that the contentions for a shorter day are wrong. He has often tried it out in his own factory, and he knows. He does not tell that the speed of the machine sometimes determines the output. He takes no account of fatigue, of increased cost of labor turnover, spoiled work, accidents, illness, and the ultimate injury to the worker's health. He, too, is not only "tied by an idea" but tainted with the motive of industry. It has ever been difficult to accept a new idea when the mind is filled with ideas which have been so long believed and accepted that they have become "institutional."

There are many hitherto unrecognized causes of fatigue. Prof. Irving Fisher points out that any successful life must satisfy six or seven of the great fundamental instincts—self-preservation, self-expression, the instinct of workmanship, self-sacrifice, the home-making instinct, loyalty, and the instinct of worship. He says: "In order that the laboring man may live his life he must satisfy something more than the instinct of self-preservation \* \* \*. Their souls are hungry and thirsty to satisfy these great instincts. \* \* \*"  
(3, pp. 14-15) while their employers assume that they are interested only in wages. "To use the workingman's arms and legs, and to ignore that he has a brain is to ruin him as a craftsman and to degrade him as a man."

Mr. Louis D. Brandeis, in discussing this same problem (13, p. 7659), says:

Unrest, in my mind, never can be removed, and fortunately never can be removed by mere improvement of the physical and material condition of the workingman. If it were, we should run great risk of improving their material condition and reducing their manhood. We must bear in mind all the time that however much we may desire material improvement, and must desire it for the comfort of the individual, that we are a democracy; and that we must have, above all things, men; and it is the development of manhood to which an industrial and social system must be directed.

The point to be emphasized is that when these great fundamental instincts are not satisfied, or at least more than one of them, the result is an atmosphere of discontent that is a potent, fruitful source of fatigue. It was not the size of the salary alone that sent our boys to Europe or "over the top."

Whichever man is right—Prof. Irving Fisher; or Dr. Cabot, who says (2) that life consists of four things: work, play, love, and worship; or Edward L. Thorndike; or Carleton H. Parker; or Watson, or Johns Hopkins—two facts remain, namely, that these instincts, or appetences, are primal tendencies, and that repression of them results in increased irritability, "balked disposition," and becomes a source of fatigue and thus of lessened efficiency. On the other hand,

where the worker is permitted to exercise his natural instincts, especially of creative workmanship, and of exploration and invention, we see the human machine at its best, functioning with the minimum of strain, and therefore the minimum of overfatigue, and incidentally with increased happiness, if Aristotle was right when he said that happiness consisted in the exercise of normal function.

These instincts can not be abolished by any human power, and suppression of them with consequent "balked disposition" may lead to unpleasant or even disastrous consequences and are a fruitful source of unrest and fatigue.

Fatigue puts the worker in an abnormal frame of mind. The first striking effect of fatigue, whether of a muscle or of a man, is increased irritability. This leads him to attempt to deaden his fatigue by excesses of various kinds, such as tobacco, alcohol, exciting amusements; these again, in turn, leading to increased susceptibility to infection of all kinds, because his powers of resistance are diminished.

One of the powerful, important factors making directly for fatigue is the "sense of economic insecurity." This haunting fear is especially noticeable in the seasonal trades. What the worker needs is the stabilizing of employment rather than charity, and the shorter day is a step in this direction.

### **The measure of industrial fatigue.**

Having formed something of a mental picture of what fatigue is, the next practical question for solution is how shall we measure it. It has been shown that in the production of industrial fatigue there are many elements, that it is a complex problem, and yet it is possible to measure it with a considerable degree of accuracy.

The first and most important means of measuring fatigue is by estimating output. Estimating output not only enables the measurement of fatigue, it also enables the determination and establishment of a physiological standard for a day's work. In other words, it will determine just how many hours are required to produce the maximum of output without overfatigue.

Space forbids reference to much of the large amount of rapidly accumulating evidence supplied by most trustworthy authorities in this field, but a brief account of the work of the Illinois Industrial Survey (7) will indicate the trend of the findings which are being generally secured on the subject of output and hours.

In 1918 the Illinois Industrial Survey Commission was appointed by Gov. Frank O. Lowden in accordance with an act of the legislature, directing the commission to "make a complete survey of all those industries in Illinois in which women are engaged as workers, with special reference to the hours of labor for women in such industries" and "the effect of such hours of labor upon the health of the women workers."

One of the studies in this survey (7, p. 71-80) consisted in making a comparison of output in the 8½-hour day with the output in the 10-hour day, in three establishments where all the shop conditions remained the same, the only change being from a 10 to an 8½ hour day.

One of the establishments investigated was a soap-making plant which had changed its standard hours per day from 10 to 8½ and its standard week from 55 to 48 hours. This change was made early in the summer of 1918.



A group of 24 workers was selected for study. These 24 were all workers who had been employed by the company at the same occupation, wrapping and packing a standard brand of soap, for at least three years previous to the period of which study was made. This group of workers was studied 10 weeks under the long-hour and 10 weeks under the short-hour schedule. At both of these times the department was running to capacity, so that no shortage of material would decrease production. In fact, the pressure of work was so great that a night shift was established during the first period and was kept at work during the second period.

The work consisted of wrapping cakes of soap and packing them in cases for sealing and shipment. Five cases an hour has always been considered a good average rate of production, a rate which would lead to a production of 50 cases under a 10-hour day, and 42 to 43 cases under an 8½-hour day. The girls in the special group studied, being the best of the operators, would produce up to the maximum rate per hour.

Facts disclosed in the report of the survey by an analysis of production under the long and short working days were:

1. The group studied packed an average of 5.1 cases per hour under the 10-hour day; under the 8½-hour day the same girls packed an average of 5.7 cases per hour, an increase of over half a case per hour, or 11.8 per cent.

2. This increase is not due to the necessity for producing more in order to earn the same wages, as piece rates were increased 33½ per cent at the same time that the hours were decreased.

3. The average production per day under the 55-hour week was 42.8 cases. Under the 48-hour week the average production per day was 45.5 cases.

4. Production under the shorter work day and week held a great deal steadier than production under the longer hour schedule. During the first 10-week period studied the production rate fluctuated from 4.1 cases per hour to 6.5 cases per hour. During the second 10-week period studied this fluctuation was from 5.3 to 6.2 cases per hour. This steadiness of production is probably indicative of a greater reserve of energy on the part of the worker, and so of less fatigue.

That the output per hour is higher under the short-hour system controverts the statements made by the company official who asserted that employees limited their production to five cases per hour, and that the limit held whether the working day was 10 hours or 8½ hours in length. No indications were found that the workers in this department limit their own production. With the increase in energy caused by lessened work time, production tends to find its own maximum level and holds steady at a higher point.

Graphic illustrations of increased output under a shortened working day were found in a large corset factory, employing women almost exclusively, which was also included in the Illinois survey.

On October 1, 1917, the hours in this factory were reduced from 54 to 48 per week. Piece rates remained the same. The report of the survey states that some of the results of the change in hours were:

1. The average output of the entire factory per employee per day increased from 0.831 dozen in 1916 to 0.883 dozen in 1918, an increase per hour of over 19 per cent.

2. Within a group of 36 steady, experienced workers the weekly output increased 13.4 per cent and the hourly output 31.6 per cent following the decrease in hours.

3. This increase in production was not spasmodic, but was maintained over the entire year following the reduction in hours. No change in machinery or working conditions was made during the period covered by the study.

4. In July, 1918, nine months after the decrease in hours, a 10 per cent wage bonus was instituted. Production during the two months following increased 2.5 per hour, a practically negligible amount.

The 36 individual workers studied had been employed in this factory for over a year previous to the change in hours.

They came from various departments, as follows: Strippers 6, eyeletter 1, steel stitchers 2, seamers 7, folder 1, paste machine 1, binders 4, clasp seamer 1, boner 1, garters 5, finisher 1, lace binders 2, baster 1, shaper 1, tackers 2; total 36.

In this factory wage is an accurate gauge of output in any one department. In studying the 36 experienced workers, therefore, the wage records were taken as output records.

During the last five weeks under the 54-hour week the average weekly wage per girl was \$10.25, or 19 cents per hour. During the eight weeks following the change it was \$11.29. During the year following the change it was \$11.62. In other words, the shortening of the week meant an immediate increase in output within this group of 10.1 per cent and an average increase for the ensuing year of 13.4 per cent.

It might be claimed that the fact that the piece rates remained the same before as after the change in hours might be responsible for "speeding" on the part of the employees and that this "speeding" might account for the increase in the output. If this rate of production could be kept up by the same people throughout the period of a year under the shorter hours, it may safely be concluded that the increased speed was not "speeding" in the sense of an acceleration of production beyond a rate normally possible to the worker.

Another group of workers selected for an intensive study during this survey consisted of the buttonhole makers in a large garment factory. The report states that the facts which made a study of this department valuable are:

1. No conditions of personnel, labor turnover, character of work, or sanitation have changed during the four-year period covered by the study.

2. Hours have been reduced from 54 to 49 weekly in the period from 1913 to 1917.

3. Wages have increased at each decrease in hours. If this had not been the case, it might be supposed that employees would "speed up" in order to earn as much after as before the change in hours.

4. Buttonhole making is piecework, and records on hours and output are therefore complete and available for study. All work studied was done by hand.

With this background the findings of the study are particularly significant. The report states:

The piece rates in January, 1918, were 29.8 per cent higher than in January, 1913. According to the cost of living series of the United States Bureau of Labor Statistics (p. 17, No. 5, whole No. 228), the cost of food increased during the same period about 30 per cent. It is, therefore, seen that better standards of living did not bring about increased productivity, since the increase in the cost of living during the four-year period from 1913 to 1917 was fully sufficient to absorb the increase in wages.

The number of buttonhole makers varies from 50 to 100 in this factory. The turnover is about 200 per cent annually. The women who do this work are of a good grade of intelligence. The character of the working force has not changed during the years studied. The average age of these women is about 27 years, and this has not changed materially in the last five years.

In this work the months of January and July are at the height of the busy season. The slack season months sometimes show a low production, because of an over supply of workers for the amount of material. The month of January was chosen for study because of the fact that production would be almost even at that time.

The buttonhole on which rates are based is a standard buttonhole, and variations are referred to this standard to determine the rate of compensation. Thus, if a buttonhole requires half as much time and labor on the employee's part as the standard buttonhole, it is paid for at half the rate. Production figures in this study refer to the number of standard buttonholes. The quality of the material and the difficulty of the work have not changed in the four years from 1913 to 1917 to any perceptible degree. As no machinery whatever is used in the operation of making buttonholes, there could be no change in this respect.

Hours in the factory studied have decreased as follows:

	Hours weekly.
May 1, 1915-----	54 to 52
May 1, 1916-----	52 to 49
Jan. 22, 1917-----	49 to 43

This study covers the month of January in 1913, 1914, and 1917. The rate changes during this period were:

May 1, 1913, a 10 per cent increase.

May 1, 1916, an increase of over 18 per cent.

In the four-year period from January, 1913, to January, 1917, the rate of buttonhole making for the group of workers studied, all of whom put in full time during the entire month of January, increased from 6.9 to 7.4 per hour per worker, and the increase was more than sufficient to make production for the entire month in 1917 equal to that in January, 1913, in spite of the decrease in working hours of five hours per week.

These figures conclusively show that the production rate in this department has increased so much that total output under a time schedule five hours less is equal to and even greater than production under the longer hours.

The investigator was told that the same conditions hold in other departments in the factory, so that fewer workers are required for an equal volume of production at present than was the case five years ago.

"Health conditions have considerably improved in this factory during the past five years. The reduced hours have, in the opinion of the factory health officer, been a considerable factor in promoting health, in increasing content among the workers, and so in raising the rate of production.

The commission has reached its conclusions—we wish to make this point clear—almost entirely on the basis of its belief that its investigations show that longer hours than 8 per day or 48 per week tend to produce harmful physiologic, or perhaps it would be better to say pathologic, fatigue in women workers. They further recognize—they can not do otherwise—that women as a class are not as strong as men, that many of them are of necessity more or less occupied outside their working hours with exacting home duties, and that many of them are to be the mothers of the future. For all these reasons the State should throw legal safeguards about them." (7, p. 10.)

The relation between hours and output is not, however, the only way of determining the effect of long hours on fatigue. A second means of measuring fatigue is by noting the number and time of occurrence of accidents.

Statistics from all countries which have recorded the hours in which industrial accidents occur, show that the number of accidents tends to increase with the incidence of fatigue, due to the fact that when the brain is fatigued the attention may flag and "reaction time" is retarded. (Reaction time is the name given to the interval of time between the occurrence of some external phenomenon and the signal of its having been perceived.)

The result of this \* \* \* is that accidents connected with work must be more numerous as the day advances, more numerous, too, in the corresponding hours at the end than at the beginning of the week, if work is pressed too far. The statistics of the distribution of accidents connection with labor therefore constitute an indication of the degree of fatigue of the human motor. (9, p. 24.)

A similar situation is also exemplified in those industries and trades where errors and mistakes occur instead of accidents. Imbert and Mestre charted over 2,700 accidents among over 60,000 workmen in various trades and constructed a curve of them.

The results may be grouped as follows: (1) The number of accidents increases progressively from hour to hour during the first half-day; (2) after the fairly long midday rest, in the early hours of the second half-day, the

number of accidents is notably less than during the last hour of the morning; (3) in the course of the second half of the day the accidents again become progressively more frequent from hour to hour; (4) the number of accidents per hour toward the end of the second half-day is notably higher than the corresponding maximum of the morning. (9, p. 40-41.)

Not only does fatigue decrease output and increase accidents, but its effect upon health is so marked that a third plan of measuring fatigue is by noting these effects upon the health of the average worker.

Overfatigue not only increases the susceptibility of workers to general and infectious diseases but also to many forms of nervous diseases as well, especially in those forms of work in which there are the elements of physical work and of nervous tension and psychological effects as well.

Mosso's work has been confirmed by Ioteyko, who has shown (9, p. 23-24) that "the exhaustion of our bodies does not increase in direct ratio with the work accomplished \* \* \* a given task performed by a fatigued muscle has a much more injurious effect upon that muscle, and results in the production of greater fatigue than would be the case if the same task were performed under normal conditions. \* \* \* When the body is tired a small amount of labor produces disastrous results."

Scientific laboratory experiments made both at home and abroad amply demonstrate that fatigue markedly diminishes the power of the blood to destroy bacteria and neutralize their toxic products. Even immunity may be destroyed for the time being by fatigue. Here comes in the problem in public health since the overfatigued individual not only early acquires, but also spreads disease.

Workers in dangerous trades who are overfatigued are more readily attacked by occupational diseases. Overfatigue and exhaustion are permanent factors in predisposing to disease or premature death in all industries. A high labor turnover caused by sickness or discontent and an increase in the amount of spoiled work can also be charged to overfatigued workers.

Physical debility follows fatigue. Laxity of moral fiber follows physical debility. Long hours and overwork lead to intemperance.

### **Legal aspects of the problem.**

In any discussion of the laws which limit an adult's hours of labor, we must constantly bear in mind the fact that no law is final in the United States until it has passed the review of the courts, and that it is the function of the courts to determine whether the legislature had any reasonable grounds for its action; not whether the laws as enacted are in themselves inherently good or bad, but whether the legislature was justified in its conclusions as embodied in the laws.

In 1908 the United States Supreme Court unequivocally upheld the constitutionality of the 10-hour law for women as a health measure, saying (14, p. 421-422), "as healthy mothers are essential to vigorous offspring, the physical well-being of woman becomes an object of public interest and care in order to preserve the strength and vigor of the race."

"The limitations which this statute places upon her contractual powers, upon her right to agree with her employer as to the time when she shall labor, are not imposed solely for her benefit, but also largely for the benefit of all."

This was the most sweeping decision ever rendered by the Federal Supreme Court in relation to working hours. It was not confined to a consideration of the 10-hour day or to a working day of any length. It left to the individual States the liberty, under their police power, to determine what is wholesome and reasonable, rejecting the fiction of the freedom of contract as regards the working woman, declaring that "her physical structure and a proper discharge of her maternal functions—having in view not merely her own health, but the well-being of the race—justify legislation to protect her from the greed as well as the passion of man." (14, p. 422.)

In 1910 the constitutionality of the 10-hour law for women in Illinois was upheld by the Illinois Supreme Court, following the decision of the United States Supreme Court in the Oregon case, in which it did find a clear connection between the measure and the protection of public health, not being deterred by a fictional theoretical "freedom of contract" idea as a previous supreme court had been 14 years previously, saying, "what we know as men we can not profess to be ignorant of as judges." (8, p. 520.)

The constitutionality of a 10-hour working day was now established, but the reasonableness of further restriction was in doubt. In 1915 the United States Supreme Court upheld the constitutionality of the California law which fixed an 8-hour day as the maximum for women workers, saying that "this is not to imply that a limitation of the hours of labor of women might not be pushed to a wholly indefensible extreme, but there is no ground for the conclusion here that the limit of the reasonable exertion of protective authority has been overstepped." (15, p. 382.)

The establishment of standards of working hours lies chiefly with the individual States as a legitimate exercise of their police power, and to this field of statesmanship, we have seen, the fourteenth amendment to the Constitution offers no barriers.

The need of this legislation is shown by the fact that in 9 States women may work 70 hours or more per week; in 20 States 55 to 70 hours. In six States there is no limitation whatever of the hours women may work, and in only five is the 48-hour week recognized by law.

The Congress of the United States has established the 8-hour day as the standard in the Government service for workers in private employment engaged on Government contracts and for certain specified groups of employees exclusive of clerical and professional workers.

In 1919 the Paris Peace Conference adopted the principle which had been recommended by the Commission on International Labor Legislation: "The adoption of an 8-hour day or a 48-hour week as the standard to be aimed at where it has not already been attained." (1, art. 427, p. 186.)

It has been said that "there is no wiser statesmanship than that which concerns itself with the care of the child." No one would minimize the importance of any phase of child welfare work; but it would seem that if the highest type is to be realized the wisest statesmanship is that which concerns itself with the welfare of the young women who are the prospective mothers of the future race.

If individuals and firms and even States are so lacking in their social development that they are willing to sacrifice these women to industrial advantage, and especially where the States fail, as five of them have utterly failed to provide any form of protective labor legislation for women, and where, as in Illinois, the legislation is unsatisfactory and inadequate, then organized society must take action.

Not only must organized society protect women as workers, at least as much as men, in their inalienable right to the joy of labor, but it must protect itself from any of the evil or sinister effects connected with their labor as women. This is not, and can not be, purely a personal matter between employer and employee, as the former would try to make us believe.

The increasing impairment of racial integrity shows that we must think for the future and of racial as well as social stability. Conservation must be applied to our heritage of health, not to the end that women may become like men or more masculine, but that they may become more feminine, to the end that happiness may be found in fulfillment of function.

Owing to the complexity and variation in the character of industry and the strains in it, it is apparent that it is impossible to make a standard of hours for each industry, based on fatigue, but it is possible to have two or three levels or standards of hours dependent upon the physical and psychological strains of the industry. However, a maximum would be a splendid start, and it would soon be possible to demonstrate the economic and social value of a physiological standard, once it is given a fair trial.

Science must be applied not only to immediate economic needs, but also to greater individual and racial resistance to disease, for the quality of our citizens will determine the character of our civilization.

Surely it is not enough that a woman is able to endure the hardship and fatigue of a 10-hour day and not die! Life for a woman should mean more than wage earning, and women should, and do, mean more to our country than mere machines. We should see to it that while engaged in the industries her hours of labor are short enough to enable her to develop into a normal, healthy, valuable member of society.

To secure such an amendment to the Federal Constitution as will permit the Federal Government to take direct charge of this matter, the 12,000,000 women in industry in this country should unite with the other millions of women voters. The probable attitude of the Congress has already been indicated in having established the 8-hour day for certain groups of its employees, the Federal Government being the largest employer of labor in the United States.

The sciences of physiology and psychology, the law, the decisions of the courts, the police power of the States, the example of the Congress, the peace conference, the joint interests of both employer and employee, the rights of society expressed in the voice of an enlightened social conscience, all unite in favoring the establishment of the 8-hour day as the maximum which should be required of women in industry. For upon the women depends the vigor of the race, and the vigor of the race must not be exploited for present-day purposes instead of for racial conservation.



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